

Amendment under 37 C.F.R. § 1.111
U.S. Application No. 10/761,256

REMARKS

Claims 1-6, 12 and 13 have been examined. Claims 1-6 are rejected under 35 U.S.C. § 102(e) and claims 12 and 13 are rejected under 35 U.S.C. § 103(a).

I. Rejections under 35 U.S.C. § 102(e)

The Examiner has rejected claims 1-6 under 35 U.S.C. § 102(e) as allegedly being anticipated by U.S. Publication No. 2003/0137050 to Chambers et al. ("Chambers").

A. Claim 1

Applicant submits that claim 1 is patentable over the cited reference. For example, claim 1 recites that a density of additive silicon atoms ranges between 0.01 atomic % and 8 atomic % of total atoms in a first Cu interconnection, where a density of the additive silicon atoms is higher in a vicinity of the top surface than in vicinities of a bottom and side surfaces. Further, the additive silicon atoms are diffused by irradiating the first Cu interconnection with a silane-containing gas, such that a silicide reaction of Cu does not occur.

Applicant submits that in order to improve the reliability of a Cu interconnection, it is essential to add Si at a concentration of around 8 atomic % on the top surface portion of the Cu interconnect *while preventing a silicide reaction thereof*. Applicant submits that the method of Chambers cannot add the Si at 0.09 atomic % or higher, and therefore, does not teach or suggest the claimed semiconductor device. Applicant submits that the method of Chambers would result in an insufficient improvement of the reliability of the Cu interconnect.

At least based on the foregoing, Applicant submits that claim 1 is patentable over the cited reference.

B. Claims 2-6

Since claims 2-6 are dependent upon claim 1, Applicant submits that such claims are patentable at least by virtue of their dependency.

In addition, claim 6 recites that the first Cu interconnection and the second Cu interconnection are connected together via a Cu plug covered with a barrier metal film.

Assuming *arguendo* that the via 170, shown in Fig. 1 of Chambers, discloses a type of Cu plug between metallization layers 1 and 2 (i.e., alleged first and second Cu interconnections), Chambers fails to teach or suggest that the barrier layer 300 is provided to cover the via 170. Rather, as disclosed in the reference, the element 300 is a barrier layer that is used to prevent inter-diffusion between a plug or contact and a *bottom electrode layer* (Figs. 3-5; para. [0023]).

Additionally, in paragraph [0018] of Chambers, it is disclosed that the via 170 may comprise *either* metal or the same materials as is used for the interconnect, i.e., $\text{Cu}_x\text{C}_y\text{Si}_z$. There is no disclosure that the via 170 is made of the $\text{Cu}_x\text{C}_y\text{Si}_z$ and is covered with a barrier metal film, as recited in claim 6. For at least these additional reasons, Applicant submits that claim 6 is patentable over the cited references.

II. Rejections under 35 U.S.C. § 103(a)

The Examiner has rejected claims 12 and 13 under 35 U.S.C. § 103(a) as allegedly being unpatentable over Chambers. However, since claims 12 and 13 are dependent upon claim 1, Applicant submits that such claims are patentable at least by virtue of their dependency.

Amendment under 37 C.F.R. § 1.111
U.S. Application No. 10/761,256

III. Newly Added Claims

By this Amendment, Applicant has added claims 14-16 to provide more varied coverage of the present invention.

IV. Conclusion

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

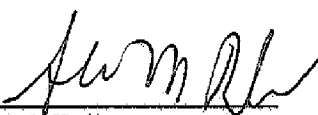
Respectfully submitted,

SUGHRUE MION, PLLC
Telephone: (202) 293-7060
Facsimile: (202) 293-7860

WASHINGTON OFFICE

23373

CUSTOMER NUMBER


Allison M. Tulino
Registration No. 48,294

Date: October 12, 2006